CLAIMS

[00468] We claim:

1. An isolated and purified nucleic acid comprising a nucleotide sequence selected from the group consisting of a nucleotide sequence encoding an ISUM2A polypeptide having an amino acid sequence that is at least 95% identical to SEQ ID NO:5, a nucleotide sequence encoding an ISUM2A fragment having an amino acid sequence identical to at least 100 consecutive amino acids of SEQ ID NO:5, a nucleotide sequence encoding an ISUM2A polypeptide having an amino acid sequence that is at least 95% identical to SEQ ID NO:6, and a nucleotide sequence encoding an ISUM2A fragment having an amino acid sequence identical to at least 100 consecutive amino acids of SEQ ID NO:6, and complements thereof.

2. The nucleic acid of claim 1, comprising a nucleotide sequence selected from the group consisting of a nucleotide sequence having at least 95% nucleotide identity with the nucleotide sequence SEQ ID NO:1, a nucleotide sequence complementary to a nucleotide sequence having at least 95% nucleotide identity with the nucleotide sequence SEQ ID NO:1, a nucleotide sequence identical to at least 300 consecutive

nucleotides of SEQ ID NO:1, and a nucleotide sequence complementary to a nucleotide sequence identical to at least 300 consecutive nucleotides of SEQ ID NO:1.

3. The nucleic acid of claim 1, comprising a nucleotide sequence selected from the group consisting of a nucleotide sequence having at least 95% nucleotide identity with the nucleotide sequence SEQ ID NO:2, a nucleotide sequence complementary to a nucleotide sequence having at least 95% nucleotide identity with the nucleotide sequence SEQ ID NO:2, a nucleotide sequence identical to at least 300 consecutive nucleotides of SEQ ID NO:2, and a nucleotide sequence complementary to a nucleotide sequence identical to at least 300 consecutive nucleotides of SEQ ID NO:2.

4. The nucleic acid of claim 1, comprising a nucleotide sequence selected from the group consisting of a nucleotide sequence having at least 99% nucleotide identity with the nucleotide sequence SEQ ID NO:3, a nucleotide sequence complementary to a nucleotide sequence having at least 99% nucleotide identity with the nucleotide sequence SEQ ID NO:3, a nucleotide sequence identical to at least 300 consecutive nucleotides of SEQ ID NO:3, and a nucleotide sequence complementary to a nucleotide sequence identical to at least 300 consecutive nucleotides of SEQ ID NO:3.

5. The nucleic acid of claim 1, comprising a nucleotide sequence selected from the group consisting of a nucleotide sequence having at least 99% nucleotide identity with the nucleotide sequence SEQ ID NO:4, a nucleotide sequence complementary to a nucleotide sequence having at least 99% nucleotide identity with the nucleotide sequence SEQ ID NO:4, a nucleotide sequence identical to at least 300 consecutive nucleotides of SEQ ID NO:4, and a nucleotide sequence complementary to a nucleotide sequence identical to at least 300 consecutive nucleotides of SEQ ID NO:4.

6. The nucleic acid of claim 1 further comprising an expression control sequence operably linked to the nucleotide sequence.

7. The nucleic acid of claim 6, wherein the expression control sequence allows overexpression of the nucleotide sequence.

8. The nucleic acid of claim 6, wherein the expression control sequence is sensitive to the action of an inducer signal.

9. The nucleic acid of claim 6, wherein the expression control sequence is an inducible transcription- or translation-represssing sequence.

10. The nucleic acid of claim 6, wherein the expression control sequence is an inducible transcription- or translation-activating sequence.

11. The nucleic acid of claim 10, wherein the inducible activator polynucleotide is a polynucleotide encoding the GVG activator, operably linked to the rice actin 1 gene promoter.

12. An isolated and purified nucleic acid comprising at least 12 nucleotides that hybridizes specifically with a nucleic acid comprising a nucleotide sequence selected from the group consisting of a nucleotide sequence encoding an ISUM2A polypeptide having an amino acid sequence that is at least 95% identical to SEQ ID NO:5, a nucleotide sequence encoding an ISUM2A fragment having an amino acid sequence identical to at least 100 consecutive amino acids of SEQ ID NO:5, a nucleotide sequence encoding an ISUM2A polypeptide having an amino acid sequence that is at least 95% identical to SEQ ID NO:6, and a nucleotide sequence encoding an ISUM2A fragment having an amino acid sequence identical to at least 100 consecutive amino acids of SEQ ID NO:6, and complements thereof.

13. An isolated and purified nucleic acid that hybridizes specifically with a nucleic acid encoding an ISUM2A

polypeptide, the sequence of which is selected from the group consisting of SEQ ID NOS:10, 11, 12, 13, 17, 18, 19, 20, 21, 22, and 23.

14. A method of detecting the presence of an ISUM2A polypeptide in a sample, comprising:

contacting

a sample prospectively comprising a nucleic acid encoding an ISUM2A polypeptide with

an isolated and purified probe nucleic acid comprising at least 12 nucleotides that hybridizes specifically with a nucleic acid comprising a nucleotide sequence selected from the group consisting of a nucleotide sequence encoding an ISUM2A polypeptide having an amino acid sequence that is at least 95% identical to SEQ ID NO:5, a nucleotide sequence encoding an ISUM2A fragment having an amino acid sequence identical to at least 100 consecutive amino acids of SEQ ID NO:5, a nucleotide sequence encoding an ISUM2A polypeptide having an amino acid sequence that is at least 95% identical to SEQ ID NO:6, and a nucleotide sequence encoding an ISUM2A fragment having an amino acid

sequence identical to at least 100 consecutive amino acids of SEQ ID NO:6, and complements thereof,

under conditions that permit specific hybridization of probe and target nucleic acids.

15. A recombinant vector comprising the nucleic acid of claim 1.

16. A host cell transformed with the nucleic acid of claim 1 or with the recombinant vector of claim 15.

17. The host cell of claim 16, wherein the host cell is a plant cell.

18. The use of the nucleic acid of claim 1 for producing a transformed plant capable of producing grains with altered germ development.

19. The use of the nucleic acid of claim 6 for obtaining a transformed plant capable of producing grains rich in oil.

20. A plant transformed with the nucleic acid of claim 1 or with the recombinant vector of claim 15.

21. A transformed plant comprising a plurality of the host cells of claim 17.

22. The transformed plant of claim 21, wherein the transformed plant has been derived from a plant in which the two

endogenous copies of the *Isum2A* gene each comprise at least one mutation which causes a deficiency in the production of an ISUM2A polypeptide of sequence SEQ ID NO:5 or 6.

23. A method for obtaining a transformed plant capable of producing grains with altered germ development, comprising:

a) transforming at least one plant cell with the nucleic acid of claim 6 or with a recombinant vector comprising the nucleic acid of claim 6;

b) selecting the transformed cells obtained in step (a) which have integrated into their genome at least one copy of the nucleic acid of claim 6;

c) regenerating a transformed plant from the transformed cells obtained in step (b).

24. The method of claim 23, in which at least one plant cell is transformed in step (a) with *Agrobacterium tumefaciens* containing the nucleic acid of claim 6 or with a recombinant vector comprising the nucleic acid of claim 6.

25. A transformed plant obtained by the method of claim 23.

26. A hybrid transgenic plant obtained by crossing the plant of claim 25.

27. A part of the transformed plant of claim 25.

28. A method for obtaining plant grains with altered germ development, comprising:

a) cultivating, until pollination,

a plant in which the two endogenous copies of the *Isum2A* gene each comprise at least one mutation which causes a deficiency in the production of an ISUM2A polypeptide, and into the genome of which has been introduced the nucleic acid of claim 9,

in the absence of the repressor inducer signal to which the repressor expression control sequence is sensitive;

b) bringing the transformed plant defined in (a) into contact with the repressor inducer signal to which the repressor expression control sequence is sensitive, for a period of time ranging from the beginning of pollination to the end of grain formation;

c) recovering the mature grains altered in germ development.

29. A method for obtaining plant grains with altered germ development, comprising:

a) cultivating, until pollination,

a plant in which the two endogenous copies of the *Isum2A* gene each comprise at least one mutation which causes a deficiency in the production of an ISUM2A polypeptide, and into the genome of which has been introduced the nucleic acid of claim 10,

in the presence of the activator inducer signal to which the activator expression control sequence is sensitive;

b) continuing the cultivation of the transformed plant defined in (a) in the absence of the activator inducer signal to which the activator expression control sequence is sensitive, from the period following pollination;

c) recovering the mature grains altered in germ development.

30. A seed altered in germ development obtained by the method of either claim 28 or 29.

31. A seed altered in germ development comprising the nucleic acid of claim 6.

32. A product of the seed of claim 30.

33. The product of claim 32, wherein the product is a starch.

34. The product of claim 32, wherein the product is a seed meal or an oil.

35. An isolated and purified ISUM2A polypeptide or an isolated and purified fragment an ISUM2A polypeptide encoded by a nucleic acid comprising a nucleotide sequence selected from the group consisting of a nucleotide sequence encoding an ISUM2A polypeptide having an amino acid sequence that is at least 95% identical to SEQ ID NO:5, a nucleotide sequence encoding an ISUM2A fragment having an amino acid sequence identical to at least 100 consecutive amino acids of SEQ ID NO:5, a nucleotide sequence encoding an ISUM2A polypeptide having an amino acid sequence that is at least 95% identical to SEQ ID NO:6, and a nucleotide sequence encoding an ISUM2A fragment having an amino acid sequence identical to at least 100 consecutive amino acids of SEQ ID NO:6, and complements thereof.

36. The polypeptide of claim 35 having an amino acid sequence that is at least 95% amino acid identical to SEQ ID NO:5 or SEQ ID NO:6.

37. An antibody directed against the polypeptide of claim 35.

38. A method for detecting the presence of the polypeptide of claim 35, in a sample, comprising:

(a) contacting the sample with an antibody directed against the polypeptide of claim 35; and

(b) detecting formation of an antigen/antibody complex.

39. A kit for detecting the polypeptide of claim 35, in a sample, comprising:

(a) an antibody directed against the polypeptide of claim 35; and

(b) optionally, one or more reagents required for the detection of the antigen/antibody complex.

40. The use of a nucleic acid or of an allelic variant of the nucleic acid of claim 1, in selection programs for obtaining plants with modified embyro size and/or development influencing the content of starch and/or of oil.

41. A method for selecting plants with modified embryo size and/or development, comprising:

(a) genotyping individual plants of a group of two or more plants using the nucleotide probe of claim 12; and

(b) selecting, from these plants (individuals), those which comprise a high frequency of favorable alleles associated with the size and/or development of the embryo.